**🛡️ Face Mask Detection with Real-Time Voice Alert**

**📌 Project Overview**

**This project is a computer vision application that detects whether individuals are wearing a face mask in a live video stream. It leverages a pre-trained deep learning model (MobileNetV2) for image classification and OpenCV’s DNN module for face detection. The application also includes a voice alert feature using pyttsx3 for audible feedback when someone is not wearing a mask.**

**🧰 Features**

* **Real-time face detection using OpenCV’s deep learning-based SSD face detector.**
* **Classification of detected faces as “Mask” or “No Mask” using a MobileNetV2-based model.**
* **Audible alerts via system voice to announce mask status changes.**
* **Visual feedback with labeled bounding boxes and confidence scores.**

**🗃️ Project Structure**

FaceMaskDetection/

├── face\_detector/

│ ├── deploy.prototxt

│ └── res10\_300x300\_ssd\_iter\_140000.caffemodel

├── dataset/

│ ├── with\_mask/

│ └── without\_mask/

├── mask\_detector.model

├── train\_mask\_detector.py

├── mask\_detector\_video.py

├── plot.png

**⚙️ Installation**

Install dependencies using pip:

pip install tensorflow keras imutils opencv-python pyttsx3 matplotlib scikit-learn

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You’ll also need to download the SSD face detector model from OpenCV’s GitHub and place the .prototxt and .caffemodel files in the face\_detector/ directory.

🏗️ Model Training

To train the face mask classifier, run:

python train\_mask\_detector.py

**Key Components:**

* Model: MobileNetV2 (transfer learning with custom head)
* Preprocessing: Resize to 224x224, MobileNetV2 normalization
* Augmentation: rotation, zoom, shift, flip
* Loss: Binary cross-entropy
* Output: mask\_detector.model and plot.png showing training metrics

🎥 Real-Time Detection & Audio Alerts

Run the live detection system with:

python mask\_detector\_video.py

**Functionality:**

* Detect faces using OpenCV
* Predict mask presence using the trained model
* Display prediction labels and confidence scores on screen
* Use text-to-speech to announce “Mask” or “No Mask” every few seconds or when changed

Exit the program by pressing **q**.

🚀 Future Enhancements

* Multilingual voice alerts for broader accessibility
* Deployment on Raspberry Pi or mobile devices for portability
* Integration with thermal imaging or social distancing measures
* Automatic capture/logging of violations